REMARKS

In the Office Action dated September 12, 2008, the Examiner states that Claim 8 is pending and rejected.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Masuyama (US 6,860,485) in view of Takizawa (US 6,834,861) and Goldstein (US 5,542,682) for the reasons of record. Applicant respectfully disagrees with and traverses this rejection.

Applicant respectfully asserts that prior to the present invention, the results shown in Fig 8 and Fig 9 of the present application were not predictable to those skilled in the art. Moreover, Applicant respectfully asserts that the present invention is not taught or suggested by Goldstein (USP 5,542,682), which merely discloses a coil spring having rectangular cross-sectional shape.

With respect to Fig 8 of the present application, as described on page 28, line 26- page 29, line 9, of the present specification, Pk (following capability coefficient) showing the degree of the following capability can be obtained by the following equation: As the Pk value is increased, the following capability is further enhanced, and if the Pk value is reduced, the following capability is deteriorated.

$$PK = 3 \times Ft \times d_1^2 \;/\; (E \times h_1 \times a_1^3 \times K)$$

In the above equation, Pk is the following capability coefficient, Ft is tension, d1 is a bore diameter, E is Young's modulus, h1 is a width of the oil ring in the axial direction, a1 is a width of the oil reign in the radial direction, and K is a shape coefficient.

As apparent from the above formula, in a common combined oil ring (not using a shape memory alloy), "inverse relationship between a width h1 of the oil ring in an axial direction and following capability coefficient Pk" is a common perception to those skilled in the art.

Contrary to the above-mentioned common perception to those skilled in the art, what Fig 8 of the present application shows is not merely "relationship between a width h1 of the oil ring and following capability coefficient Pk" but "variation in following capability at room temperature and at high temperature per width of the oil ring in the axial direction" when coil expanders formed of a shape memory alloy are used (page 31, line 14-17 of the present specification). That is, Fig 8 shows "relationship between width h1 of the oil ring in an axial direction and variation in

following capability before and after martensitic transformation." Prior to the present invention, there is no such literature, etc., describing the relationship between "a width h1 of the oil ring in an axial direction" and "variation in following capability before and after martensitic transformation." Thus, the common perception to those skilled in the art is that "since desired tension cannot be obtained, a coil expander formed of a shape memory alloy cannot be sued for a thin oil ring."

As described above, unexpected characteristics of the present invention are that the present invention focuses attention on the relationship between "a width h1 of the oil ring in an axial direction" and "variation in following capability before and after martensitic transformation", although those skilled in the art have never thought of such a thing. Further, the present invention has also discovered the unexpected fact that the above-mentioned relationship dramatically changes when the width of the oil ring h1 is about "2.0 mm." Applicant respectfully asserts that since those skilled in the art have never appreciated or contemplated such relationship, such a boundary point was certainly unexpected and unpredictable.

With respect to Fig 9, for common wire material such as steel, which is not a shape memory alloy, it is a common perception to those skilled in the art that when the ratio (aspect ratio) of the thickness and the width of the cross sectional shape of the wire is made larger, the tension thereof would be larger. However, what Fig 9 of the present application shows is not merely "relationship between aspect ratio and tension of a coil spring" but "relationship between aspect ratio and variable tension margin (%)". A described in page 37, lines 25-26 of the present specification, "variable tension margin" shows how the tension of a coil spring is changed after martensitic transformation, compared to the tension of the same before martensitic transformation.

The Office Action points out the disclosure of Masuyama stating "the shape and size of the coil expander can be selected to provide desired tension requirements and can be selected from know shapes, etc." However, even though Masuyama discloses a coil expander formed of a shape memory alloy, Masuyama does not teach or suggest "relationship between cross-sectional shape of a coil expander and variable tension margin thereof" as that in the present invention. Thus, Applicant respectfully asserts that it's clear that prior to the present invention, those skilled in the art have never though of relationship between "cross-sectional

shape of a coil expander" and "variable tension margin thereof."

Goldstein discloses coil spring cross-sections including a rectangular shape. However, Goldstein is completely silent about the relationship between "cross-sectional shape of a coil expander" and "tension thereof." Further, variable tension margin of the coil spring disclosed by Goldstein cannot be disputed because Goldstein dose not employ a shape memory alloy. Therefore, Applicant respectfully asserts that there is no teaching, suggestion or motivation to employ the cross-sections disclosed by Goldstein as the cross-section of a coil spring formed of a shape of memory alloy disclosed by Masuyama. For such a coil expander formed of a shape memory alloy, Applicant respectfully asserts the fact that "the variable tension margin can be made larger by making the ratio of the thickness and the width of the wire material larger" is not predictable for those skilled in the art. In particular, the fact that "growth of the variable tension margin decreases at the ratio of 1:2" is not predictable.

Prior to the present invention, a coil expander formed of a shape memory alloy could not be used for a thin oil ring because elastic modulus of the shape memory alloy is lower than that of generally used steel coil spring so that desired tension cannot be obtained. In spite of this known fact, the present invention made it possible to obtain the desired tension efficiently by employing the above-mentioned optimum aspect ratio, which was not taught or suggested in, nor was it predictable from, the prior art.

With respect to Goldstein, Applicant respectfully asserts that this reference is related to the coil spring and Goldstein teaches rectangular cross-sectional coil springs in Fig 6. However, not only does it teach the rectangular shape, Goldstein also discloses circular (including ellipsoid) cross-sectional shapes in Fig 6. From these disclosures, it is clear that Goldstein merely discloses rectangular shape just as an example of a cross-section. That is, Goldstein shows no reason why rectangular is preferable for the cross-section and provides no motivation to one of ordinary skill to utilize such a shape.

In the present invention, rectangular cross-sectional wire was employed because, as the width of an oil ring is made smaller to improve its following capability, desired tension cannot be obtained with circular cross-sectional wire. Thus, there is no motivation to select rectangular shape from the disclosure of

Goldstein, which merely discloses rectangular shape and circular shape as examples.

Further, not only does the present invention employ a rectangular shape for the cross-sections of the wire material, the present inventors have found the unpredictable or unexpected effect as shown in Examples in the present specification by limiting "the width h1 of the oil ring" and "aspect ratio of the cross-sections of the wire material." Therefore, Applicant respectfully asserts that Goldstein does not teach or suggest the present invention by merely disclosing a cross-sectional shape.

In light of the foregoing response, Applicant respectfully asserts that Claim 8 is not obvious in view of the cited prior art and respectfully requests withdrawal of the rejection of Claim 8 under 35 U.S.C. 103(a). All the outstanding objections and rejections are considered overcome. Applicant respectfully submits that this application should now be in condition for allowance and respectfully requests favorable consideration.

Respectfully submitted,

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Date

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